

CONTAINER WITH CAP RETAINER

Related Applications

5 [0001] This invention claims the benefit of the priority of Canadian patent application No. 2,442,519 (filed 23 September 2003) and Canadian patent application No. 2,450,477 (filed 18 November 2003).

Technical Field

10 [0002] This invention relates to containers having reusable caps. Particular embodiments of the invention provide containers having cap retainers on their walls and/or bases. After the containers are opened, the caps may be stored in the cap retainers and later reused to seal the containers.

Background

15 [0003] Figure 1A depicts a prior art beverage container 10. Container 10 comprises a container wall 12 and a base 13. Container 10 also comprises a rim 14, which defines a container opening 16. Opening 16 may be used to insert contents into and dispense contents from container 10. Typically, rim 14 and opening 16 are circularly shaped. Typically, container 10 will comprise a cap 18 as shown in more
20 detail in Figures 1B and 1C.

[0004] Figures 1B and 1C depict a reusable cap 18 for sealing and resealing container 10. Cap 18 comprises a top portion 20 having an exterior surface 20A and an interior surface 20B and a side portion 22 having an exterior surface 22A and an interior surface 22B. Side portion 22 of cap 18 comprises a cap rim 23, which defines a cap opening 25. In the particular container 10 of Figures 1A-1C, container 10 is sealed by extending rim 14 of container 10 into cap opening 25 and rotating container 10 and cap 18 relative to one another, such that one or more threads 24 located on rim 14 of container 10 engage corresponding thread(s) 26 on
25 cap 18. When cap 18 is coupled to container 10 in this manner, the contents of
30 container 10 are prevented from escaping.

[0005] When a cap is uncoupled from its container, the cap is separated from the container and may become lost, dirty or otherwise contaminated. In addition, it is
35 often inconvenient to have to hold the cap in one hand while using the other hand to hold the container and dispense the container's contents. For example, in the case of a beverage container, after removing the cap from the container it is necessary to use at least one hand to drink from the container opening. If a person needs to use

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their other hand for another activity (e.g. riding a bicycle, driving a car, holding onto a handbag or the like), then the person typically must put the cap down as both their hands are in use. Often, putting the cap down is done absent mindedly, which may cause the cap to become lost. Sometimes, there is no hygienic place to put the cap down and the cap can become dirty or otherwise contaminated. In addition, some of the container contents may be present on the cap and may dirty, stain or damage the material onto which the cap is placed.

[0006] Attempts to solve these problems have been devised, which include attaching the cap permanently to the container by a wire, chain or plastic tether. However, attaching the cap to the container in this manner has a number of drawbacks. When the cap is removed from the container, the cap dangles from its tether. Contents from the container which are present on the dangling cap may drip from the dangling cap. The dangling cap may also become an inconvenient obstacle for inserting contents into and withdrawing contents from the container. Moreover, the dangling cap is completely exposed to the outside environment and may become dirty or otherwise contaminated.

[0007] United States Patent No. 5,211,299 (Manfredonia) discloses a baby bottle formed with a truncated conical cap which includes an annular groove adjacent to its top wall. A bottom of the baby bottle incorporates a truncated conical cavity directed coaxially into the bottle for receiving the cap. The walls of the cavity are formed with a plurality of projections for projecting into the annular groove in the cap. The Manfredonia bottle is unhygienic because when the cap is received in the stored position, its rim and its interior surfaces are still exposed to contamination. In addition, a person must grasp the interior surfaces of the cap to insert and/or remove the cap from the cavity. Another drawback with the Manfredonia technique involves the difficulty of fabricating the bottle and cap using conventional molding techniques.

[0008] United States patent No.'s 5,897,010 and 6,131,755 (Soyka Jr. et al.) disclose a number of bottle assemblies having corresponding cap retention portions which are adapted to allow removable storage of their bottle caps. The Soyka Jr. et al. embodiments where the rim of the cap fits over a protruding cap retention portion are unhygienic because the surfaces of the protruding cap retention portion may become dirty during handling of the bottle. It is also easy for the cap to be accidentally knocked off of the protruding cap retention portion. The Soyka Jr. et

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al. embodiments where the cap fits into a depressed cap retention portion are disadvantageous, because it is difficult to insert the cap into and remove the cap from the cap retention portion that completely encircles the cap. These difficulties are exacerbated in the Soyka Jr. et al. embodiment having inwardly extending shoulders at the entrance to the cap retention portion. For the same reasons as discussed above with respect to Manfredonia, it is unhygienic to insert the cap into the depressed cap retention portion with the top portion of the cap being deepest in the depression as described in Soyka Jr. et al. In addition, the shoulders described by Soyka Jr. et al. may make it difficult to mold the Soyka Jr. depressed cap retention portion and may also make it difficult to deform the cap in a manner which facilitates easy insertion and removal thereof.

[0009] There is a general desire to provide containers having cap retainers, so that their caps may be stored and later reused in a manner which overcomes or ameliorates some of the drawbacks associated with the prior art.

Summary of the Invention

[0010] One particular aspect of the invention provides a container having a container opening and a reusable cap for sealing the container opening. The container comprises a cap retainer for storing the cap in a storage configuration when the cap is not being used to seal the opening. The cap retainer comprises a slot defined by a pair of sidewalls. The slot has at least one open end. Each of the sidewalls provides a contact surface which engages the cap for securing the cap in its storage configuration within the slot. The slot may be formed in a side wall or in the base of a container.

[0011] The cap may be slidable in a direction of a longitudinal dimension of the slot from the at least one open end of the slot to its storage configuration. The contact surfaces of the sidewalls may engage an exterior surface of a side portion of the cap. The cap may be secured in its storage configuration by frictional forces between the contact surfaces and the exterior surface of the side portion of the cap. The cap may be additionally or alternatively secured in its storage configuration by pressure associated with elastic deformation of the cap or the sidewalls.

[0012] Each of the sidewalls may comprise at least one sidewall point, where the sidewall extends transversely into the slot. The transverse dimension of the slot is narrower in a region of the at least one sidewall point when compared to the

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transverse dimension of the slot in a region of the contact surfaces. For each sidewall, the at least one sidewall point may be located between the at least one open end of the slot and the contact surface of the sidewall. The at least one sidewall point for a first of the sidewalls and the at least one sidewall point for a second of the sidewalls may be located directly, transversely across the slot from one another. The sidewalls may each comprise a pair of sidewall points and the contact surface of each sidewall may be located between its pair of sidewall points. The sidewalls may each comprise a plurality of sidewall points and a plurality of contact surfaces and each contact surface may be located between a pair of sidewall points.

[0013] The contact surfaces may be curved to correspond to a shape of the side portion of the cap. The curved contact surfaces may exert pressure on the cap such that the side portion of the cap is deformed to conform to the shape of the curved contact surfaces.

[0014] The cap retainer may comprise a wall which extends transversely between the sidewalls at one end of the slot. The transversely extending wall may comprise an additional contact surface which engages the cap for securing the cap in its storage configuration. The contact surfaces of the sidewalls and the contact surface of the transversely extending wall may be curved to correspond to a shape of the side portion of the cap.

[0015] The sidewalls may comprise an outwardly opening tapering angle in a range of 0-5°.

[0016] The cap may comprise a lip which projects radially outwardly from its side portion and each of the sidewalls may comprise a corresponding groove for receiving the cap when the cap is in its storage configuration.

[0017] The sidewalls may extend inwardly from a container wall and a base of the slot may be depressed relative to the container wall. Alternatively, the sidewalls may extend outwardly from a container wall and a base of the slot may be level with the container wall.

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[0018] At least one of the contact surfaces of the sidewalls and the exterior surface of the side portion of the cap may be coated with a layer of an elastomeric material. The cap may be secured in its storage configuration by frictional forces between the layer of elastomeric material and the contact surfaces or between the layer of elastomeric material and the exterior surface of the side portion of the cap. The cap may be secured in its storage configuration by pressure associated with elastic deformation of the elastomeric material.

[0019] Another aspect of the invention provides a container having a container opening and a reusable cap for sealing the container opening. The container comprises a cap retainer for storing the cap in a storage configuration when the cap is not being used to seal the opening. The cap retainer comprises a circularly shaped depressed region for receiving the cap. The depressed region is located between a plurality of lobes which are angularly spaced apart around a circumference thereof. Each of the lobes comprises a contact surface which engages the cap for securing the cap in its storage configuration. The container comprises channels between each of the lobes for permitting finger access to remove the cap from its storage configuration. Each of the contact surfaces may comprise an outwardly opening tapering angle in a range of 0-5°.

[0020] Another aspect of the invention provides a container having a container opening and a reusable cap for sealing the container opening. The container comprises a cap retainer for storing the cap in a storage configuration when the cap is not being used to seal the opening. The cap retainer comprises a circularly symmetric depressed region for receiving the cap. A side portion of the cap comprises one or more radially extending projections, each projection spanning an arcuate segment of a circumference of the side portion of the cap. Each of the radially extending projections engages a corresponding contact surface of the circularly symmetric depressed region for securing the cap in its storage configuration.

[0021] Another aspect of the invention provides a container comprising an opening, a reusable cap engageable with the opening and a cap retainer. The cap retainer comprises a pair of opposed sidewalls defining a slot having at least one open end. The slot comprises a cap receiving area and a narrowed throat located between the cap receiving area and the at least one open end. The narrowed throat has a transverse dimension smaller than a transverse dimension of the cap and

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smaller than a transverse dimension of the cap receiving area. Each of the sidewalls also comprises a contact surface which engages the cap when the cap is located in the cap receiving area for securing the cap therein.

- 5 [0022] Further features and applications of specific embodiments of the invention are described below.

Brief Description of the Drawings

- 10 [0023] In drawings which depict non-limiting embodiments of the invention:
Figure 1A is a side elevation view of a prior art beverage container;
Figure 1B and 1C are respectively isometric and cross-sectional views of a prior art cap for the container of Figure 1A;
Figures 2A-2C are respectively a side elevation view, a partially sectioned side view (along axis A-A) and a cross-sectional view (along axis B-B) of a
15 container according to an embodiment of the invention with its cap stored in its cap retainer;
Figure 2D is a side elevation view of the cap retainer of the container of Figures 2A-2C;
Figures 3A-3C are respectively a side elevation view, a partially sectioned
20 side view (along axis C-C) and a cross-sectional view (along axis D-D) of a container according to another particular embodiment of the invention with its cap stored in its cap retainer;
Figure 3D is a side elevation view of the cap retainer of the container of Figures 3A-3C;
25 Figures 4A-4C are respectively a side elevation view, a partially sectioned side view (along axis E-E) and a cross-sectional view (along axis F-F) of a container according to another embodiment of the invention with its cap stored in its cap retainer;
Figure 4D is a side elevation view of the cap retainer of the container of
30 Figures 4A-4C;
Figures 5A-5C are respectively a side elevation view, a partially sectioned side view (along axis G-G) and a cross-sectional view (along axis H-H) of a container according to another embodiment of the invention with its cap stored in its cap retainer;
35 Figures 6A-6B are respectively a partially sectioned side view (along axis I-I) and a cross-sectional view (along axis J-J) of a container according to another embodiment of the invention with its cap stored in its cap retainer;

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Figures 7A-7B are respectively a partially sectioned side view (along axis K-K) and a cross-sectional view (along axis L-L) of a container according to another embodiment of the invention with its cap stored in its cap retainer;

Figures 8A-8B are respectively a partially sectioned side view (along axis M-M) and a bottom view of container according to another embodiment of the present invention with its cap stored in its cap retainer;

Figures 9A and 9B are respectively a partially sectioned side view (along line N-N) and a cross-sectional view (along line O-O) of a container according to another embodiment of the present invention with its cap stored in its cap retainer;

Figures 9C and 9D are respectively a cross-sectional view (along line P-P) and a bottom view of the cap for the container of Figures 9A and 9B;

Figures 10A and 10B are respectively a partially sectioned side view (along line Q-Q) and a bottom view of a container according to another embodiment of the present invention with its cap stored in its cap retainer; and

Figures 11A and 11B are respectively a partially sectioned side view (along line R-R) and a bottom view of a container according to another embodiment of the present invention with its cap stored in its cap retainer.

Detailed Description

[0024] Throughout the following description, specific details are set forth in order to provide a more thorough understanding of the invention. However, the invention may be practiced without these particulars. In other instances, well known elements have not been shown or described in detail to avoid unnecessarily obscuring the invention. Accordingly, the specification and drawings are to be regarded in an illustrative, rather than a restrictive, sense.

[0025] Some embodiments of the invention provide containers having removable caps and cap retainers. The caps may be removed from the container openings, stored in the cap retainers and later reused to seal the containers. Some embodiments of the invention provide containers for storing beverages or other edible fluids, commonly referred to as "bottles". In preferred embodiments of the invention, the cap retainers allow the caps to be stored in a hygienic manner that minimizes the opportunities of contamination of the caps before they are used to reseal the containers.

[0026] A cap retainer comprises one or more contact surfaces which contact corresponding surface(s) of the cap to secure the cap in the cap retainer. The

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contact surfaces may be part of a recessed region formed in the container wall or the container base. Alternatively, the contact surfaces may project outwardly from the container walls and/or the container base. The cap may be secured in the cap retainer by frictional forces acting between the contact surface(s) of the cap retainer and the corresponding surfaces of the cap. In some embodiments, the contact surface(s) of the cap retainer and/or the corresponding surface(s) of the cap are made of elastically deformable material and/or are covered in a layer of elastomeric material. In such embodiments, the cap may be additionally secured in the cap retainer by pressure exerted between the contact surface(s) and the cap as a result of elastic deformation of the cap, the cap retainer and/or the elastomeric material.

[0027] Figures 2A-2D depict a container 100 having a cap 103 and a cap retainer 110 according to one embodiment of the invention. Container 100 is a bottle for holding a beverage. Container 100 comprises a container wall 101, a base 105 and a generally circular rim 102 which defines container opening 102A. Cap 103 may be substantially similar to prior art cap 18 described above. Cap 103 may be coupled to rim 102 to seal opening 102A. In the illustrated embodiment, cap 103 is threadably coupleable to rim 102. In Figures 2A-2C, cap 103 is shown in its storage configuration, wherein cap 103 is retained in cap retainer 110.

[0028] Cap retainer 110 comprises an elongated slot 110A formed between a pair of sidewalls 114, 115. At one of its ends, slot 110A comprises a wall 113 which extends transversely between sidewalls 114, 115 and at its opposing end 111, slot 110A is open. In the illustrated embodiment, as seen best in Figures 2B and 2C, slot 110A and its base 116 are recessed into container wall 101. In alternative embodiments, sidewalls 114, 115 and lower wall 113 may extend outwardly from container wall 101, such that base 116 of slot 110A is level with container wall 101.

[0029] In the illustrated embodiment, sidewalls 114, 115 and transverse wall 113 have a shape shown best in Figure 2D. At the open end 111 of slot 110A, the transverse dimension of slot 110A is relatively wide (i.e. sidewalls 114, 115 are relatively widely spaced apart from one another). As sidewall portions 114A, 115A extend away from open end 111 and toward transverse wall 113, the transverse dimension of slot 110A narrows. In the illustrated embodiment, sidewall portions 114A, 115A are generally planar angled surfaces. Sidewall portions 114A, 115A

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may also be curved. The transverse dimension of slot 110A is narrowest at sidewall points 114B, 115B. In some embodiments, sidewall points 114B, 115B may extend inwardly by a distance in a range of 0-5% of the diameter of cap 103.

- 5 [0030] As sidewall portions 114C, 115C extend below sidewall points 114B, 115B toward transverse wall 113, the transverse dimension of slot 110A increases again. Sidewall portions 114C, 115C and portion 113A of transverse wall 113 are shaped to provide a curved cap retaining bay 117. The contact surfaces of cap retaining bay 117 may be shaped correspond generally to exterior surface 146 of side portion 146A of cap 103. In some embodiments, the contact surfaces of cap retaining bay 117 may exert pressure on cap 103, such that side portion 146A of cap 103 is deformed to conform to the shape of the curved surfaces of cap retaining bay 117.
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- 15 [0031] Putting cap 103 into its storage configuration in cap retainer 110 first involves placing cap 103 into slot 110A at its open upper end 111. Preferably, a portion of cap 103 abuts against base 116 of slot 110A. Cap 103 may then be slid along the longitudinal dimension of slot 110A until it passes sidewall points 114B, 115B (i.e. the narrowest portion of slot 110A) and fits into retaining bay 117.
- 20 Sliding cap 103 past sidewall points 114B, 115B preferably involves some deformation of cap 103 and/or sidewalls 114, 115, such that when cap 103 is slid into retaining bay 117, the person placing cap 103 into cap retainer 110 hears and/or feels a "click" as cap 103 and/or sidewalls 114, 115 expand back toward their nominal (i.e. undeformed) configuration.
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- [0032] When cap 103 is received in retaining bay 117, it is in its storage configuration. Surfaces 114C, 115C, 113A of retaining bay 117 represent the contact surfaces of cap retainer 110, which contact the exterior surface 146 of side portion 146A of cap 103. Cap 103 is secured in place in its storage configuration by frictional forces acting between contact surfaces 114C, 115C, 113A of cap retainer 110 and the exterior surface 146 of side portion 146A of cap 103.
- 30 Preferably, when cap 103 is in its storage configuration, there is still some deformation of side portion 146A of cap 103 and/or contact surfaces 114C, 115C, 113A of cap retainer 110. Such elastic deformation causes pressure to be exerted
- 35 between contact surfaces 114C, 115C, 113A of cap retainer 110 and the exterior

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surface 146 of side portion 146A of cap 103. This pressure tends to hold cap 103 in place in cap retainer 110.

5 [0033] Preferably, as shown in Figures 2A-2C, cap 103 is inserted and stored into cap retainer 110 in an orientation wherein cap rim 118 (Figures 2B, 2C) abuts against base 116 of slot 110A and the exterior surface 145 of top portion 145A of cap 103 is facing outwardly. This orientation of cap 103 in cap retainer 110 promotes hygiene by minimizing the exposure of the cap opening and the interior surfaces of cap 103 to contamination. In addition, a person may insert and remove 10 cap 103 from cap retainer 110 without handling the interior surfaces of cap 103. Another benefit with this orientation is that less force is required to deform cap 103 when inserting it into cap retainer 110, as only the side portion 146A of cap 103 needs to be deformed and the top portion 145A of cap 103 need not be deformed. In some embodiments, only the region of side portion 146A closest to 15 cap rim 118 need be deformed to insert cap 103 into cap retainer 110. Those skilled in the art will appreciate that the region of side portion 146A closest to cap rim 118 is more easily deformable than the region of side portion 146A closest to top portion 145A. This orientation of cap 103 in cap retainer 110 also helps to prevent cap 103 from being permanently warped or broken because of excessive deformation.

20 [0034] Removal of cap 103 from cap retainer 110 may be accomplished in a manner opposite to that of insertion, wherein cap 103 is forced toward open end 111 of slot 110A and is subsequently removed from slot 110A. Alternatively, cap 103 may be pulled directly outwardly from slot 110A without having to slide cap 103 25 toward open end 111.

[0035] Sidewalls 114, 115 and/or transverse wall 113 may optionally be provided with a non-zero tapering angle β (Figure 2C), such that the transverse dimension of slot 110A gets wider as sidewalls 114, 115 and/or transverse wall 113 30 extend away from base 116 of slot 110A. As shown in Figure 2C, tapering angle β is measured from a plane orthogonal to base 116 of slot 110A. When cap 103 is inserted into slot 110A in the orientation discussed above, tapering angle β causes the most deformation to occur in the region of side portion 146A closest to cap rim 118. As discussed above, it is easier to deform the region of side portion 146A 35 closest to cap rim 118 than the region of side portion 146A closest to top portion 145A. Deforming this portion of cap 103 also helps to prevent cap 103 from being

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permanently warped or broken because of excessive deformation. Tapering angle β may be selected on the basis of the elastic deformation properties and friction properties of the materials used for cap 103 and cap retainer 110, such that cap 103 is adequately secured in cap retainer 110 without permanently warping or breaking cap 103. In some embodiments, tapering angle β is in the range of 0-5°. Tapering angle β may be significantly increased by coating the exterior surface 146 of side portion 146A of cap 103 and/or contact surfaces 114C, 115C, 113A with elastomeric material that increases the friction therebetween. This provides additional freedom for design and fabrication of container 100 and cap 103.

[0036] Figures 3A-3D show a container 200 and cap 203 according to another embodiment of the invention. In many respects, container 200 and cap 203 are similar to container 100 and cap 103 of Figures 2A-2D. Features of container 200 and cap 203 that are similar to features of container 100 and cap 103 are provided with similar reference numerals preceded by the digit "2" rather than "1".

[0037] One difference between container 200 and container 100 is that cap retainer 210 of container 200 comprises a slot 210A having a pair of open ends 211, 212 (i.e. transverse wall 113 is not present in cap retainer 210 of container 200). Sidewalls 214, 215 of cap retainer 210 also have different shapes than sidewalls 114, 115 of cap retainer 110. As shown best in Figure 3D, sidewall portions 214A, 215A closest to open end 211 are shaped such that the transverse dimension of slot 210A becomes narrower as sidewall portions 214A, 215A extend away from open end 211. Similarly, sidewall portions 214E, 215E closest to open end 212 are shaped such that the transverse dimension of slot 210A becomes narrower as sidewall portions 214E, 215E extend away from open end 212. In the illustrated embodiment, sidewall portions 214A, 215A, 214E, 215E are planar angled surfaces, but sidewall portions 214A, 215A, 214E, 215E may also be curved.

[0038] Slot 210A is narrowest at sidewall points 214B, 215B and at sidewall points 214D, 215D. In some embodiments, sidewall points 214B, 215B, 214D, 215D may extend inwardly by a distance in a range of 0-5% of the diameter of cap 203. As sidewalls 214, 215 extend downwardly from sidewall points 214B, 215B and upwardly from sidewall points 214D, 215D, sidewall portions 214C, 215C are shaped such that the dimension of slot 210A increases again. Sidewall portions 214C, 215C may be curved to correspond in shape to side portion 246A of cap 203.

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In some embodiments, sidewall portions **214C**, **215C** exert pressure on cap **203**, such that side portion **246A** of cap **203** is deformed to conform to the shape of the curved surfaces of sidewall portions **214C**, **215C**.

5 **[0039]** Cap **203** may be inserted and stored in cap retainer **210** from either open end **211**, **212** of slot **210A**. When inserting cap **203** into slot **210A**, a portion of cap **203** preferably abuts against base **216** of slot **210A**. Cap **203** is then slid along the longitudinal dimension of slot **210A** until it passes sidewall points **214B**, **215B** (when inserted from open end **211**) or until it passes sidewall points **214D**, **215D** (when inserted from open end **212**). Cap **203** is in its storage configuration when it reaches sidewall portions **214C**, **215C**. Sliding cap **203** past sidewall points **214B**, **215B** or sidewall points **214D**, **215D** preferably involves some deformation of cap **203** and/or sidewalls **214**, **215**, such that when cap **203** reaches sidewall portions **214C**, **215C**, the person placing cap **203** into cap retainer **210** hears and/or feels a "click" as cap **203** and/or sidewalls **214**, **215** expand back toward their nominal (i.e. undeformed) configuration.

20 **[0040]** Surfaces **214C**, **215C** represent the contact surfaces of cap retainer **210**, which contact the exterior surface **246** of side portion **246A** of cap **203**. As with cap retainer **110**, cap **203** is secured in place in the storage configuration by frictional forces acting between contact surfaces **214C**, **215C** of sidewalls **214**, **215** and or the pressure associated with the elastic deformation of sidewalls **114**, **115** and/or cap **203**. For the reasons discussed above in relation to container **100** and cap **103**, it is preferable that cap **203** be inserted into cap retainer **210** in such a manner that the cap rim **218** faces base **216** of slot **210A** and exterior surface **245** of top portion **245A** faces outwardly.

30 **[0041]** Removal of cap **203** from cap retainer **210** may be accomplished in a manner opposite that of insertion, wherein cap **203** is forced toward either open end **211**, **212** of slot **210A** and is subsequently removed from slot **210A**. Alternatively, cap **203** may be pulled directly outwardly from slot **210A** without having to slide cap **203** toward open end **211** or open end **212**.

35 **[0042]** Figures 4A-4D show a container **300** and a cap **303** according to another embodiment of the invention. In many respects, container **300** and cap **303** are similar to container **200** and cap **203** of Figures 3A-3D. Features of container

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300 and cap 303 that are similar to features of container 200 and cap 203 are provided with similar reference numerals preceded by the digit "3" rather than "2".

5 [0043] One difference between container 300 and container 200 is the shape of sidewalls 314, 315 in cap retainer 310 which comprise narrowing portions 314A, 315A (proximate to open end 311), narrowing portions 314I, 315I (proximate to open end 312), multiple sidewall points 314B, 315B; 314D, 315D; 314F, 315F; and 314H, 315H, and multiple curved contact surfaces 314C, 315C; 314E, 315E; and 314G, 315G, between which cap 303 may be retained. Those skilled in the art will appreciate that any pair of the multiple contact surfaces 314C, 315C; 314E, 315E; or 314G, 315G may be used to retain cap 303. Accordingly, cap retainer 310 provides a plurality of potential storage configurations for cap 303. Those skilled in the art will also appreciate that cap retainer 310 is shown with three pairs of contact surfaces 314C, 315C; 314E, 315E; and 314G, 315G, but that cap retainer 310 may have larger number or smaller number of pairs of contact surfaces and a correspondingly larger or smaller number of storage configurations for cap 303. Providing multiple storage configurations is advantageous because, if a user accidentally slides cap 303 too far into slot 310A and cap 303 slides past a first pair of contact surfaces (e.g. contact surfaces 314C, 315C), then cap 303 may still be retained between another pair of contact surfaces (e.g. contact surfaces 314E, 315E).

25 [0044] Another difference between container 300 and cap 303 in comparison to the previously described embodiments is that cap 303 comprises an optional lip 320 which projects radially outwardly from side portion 346A of cap 303 near cap rim 318. Sidewalls 314, 315 comprise corresponding grooves 321 for receiving lip 320 when cap 303 is inserted into slot 310A. Lip 320 and corresponding grooves 321 help to retain cap 303 in cap retainer 310. When cap 303 is inserted into slot 310A, lip 320 projects into grooves 321 such that it is more difficult to dislodge cap 303 directly outward from slot 310A. In addition, lip 320 of cap 303 and grooves 321 of container 300 may allow for slot 310A to have a relatively shallow shape.

35 [0045] Another difference between container 300 and container 200 is that cap retainer 310 of container 300 has a base 316 which is substantially planar from open end 311 through to open end 312. In contrast, as shown best in Figure 3B, cap retainer 210 comprises a curved base portion 219 near open end 212. Curved base

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portion 219 may make it easier to guide cap 203 into cap retainer 210. Those skilled in the art will appreciate that any of the slotted embodiments described herein may comprise curved base portions at one or both of their open ends.

Container 300 also differs from container 200 in that open end 312 of cap retainer 310 extends all the way to the bottom of wall 301 of container 300 (i.e. open end 312 opens onto base 305 of container 300). Those skilled in the art will appreciate that any of the cap retaining slots described herein may have one of their open ends extend to the base of its corresponding container.

10 [0046] Figures 5A-5C depict a container 400 and its cap 403 according to another embodiment of the invention. In many respects, container 400 and cap 403 are similar to the previously described containers and caps. Features of container 400 and cap 403 that are similar to features of container 100 and cap 103 are provided with similar reference numerals preceded by the digit "4" rather
15 than "1".

[0047] One difference between container 400 and the containers of the previously described embodiments is that cap retainer 410 comprises sidewalls 414, 415, which extend outwardly from container wall 401 (i.e. rather than being
20 depressed into container wall 401). Sidewalls 414, 415 form a slot 410A having a base 416 that is level with container wall 401 rather than being depressed in container wall 401.

[0048] Sidewalls 414, 415 extend substantially vertically along container wall
25 401 and are divided into upper portions 414A, 415A and lower portions 414B, 415B separated by gaps 426, 427. Sidewalls 414, 415 are straight; however, those skilled in the art will appreciate that sidewalls 414, 415 may be provided with shapes similar to those of sidewalls 114, 115, sidewalls 214, 215 or sidewalls 314, 315 having one or more sidewall point(s) and/or curved sidewall contact portion(s).
30 Slot 410A comprises upper open end 411 and lower open end 412. Those skilled in the art will appreciate that slot 410A may be provided with a transverse wall similar to transverse wall 113, except that the transverse wall of slot 410A would extend outwardly from container wall 401.

35 [0049] Cap 403 comprises a radially outwardly extending lip 420 similar to lip 320 of cap 303 (Figures 4A-4D) and sidewalls 414, 415 of slot 410A comprise

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corresponding grooves **421** similar to grooves **321** of sidewalls **314**, **315** of slot **310A** (Figures 4A-4D). When cap **403** is inserted into slot **410A**, lip **420** projects into grooves **421**, such that cap **403** is retained in cap retainer **410**. Those skilled in the art will appreciate that lip **420** and corresponding grooves **421** are optional and that cap **404** may be retained in cap retainer by frictional forces between sidewalls **414**, **415** and exterior surface **446** of side portion **446A** of cap **403** and/or pressure associated with elastic deformation of sidewalls **414**, **415** and/or cap **403**. For example, the interior lower corners of sidewall portions **414A**, **415A** and the interior upper corners of sidewall portions **414B**, **415B** may act as contact surfaces which engage the exterior surface **446** of side portion **446A** to create friction and/or deformation.

[0050] As shown best in Figure 5C, container **400** comprises a plurality of outwardly extending sidewalls to provide an optional plurality of cap retainers **410**, **430**, **440**, **450**, **460**. Cap retainers **430**, **440**, **450**, **460** are substantially similar to cap retainer **410**. Those skilled in the art will appreciate that container **400** may provide any practical number of cap retainers.

[0051] Figures 6A-6B illustrate a container **500** and its cap **503** according to yet another embodiment of the invention. Although cap retainer **510** is located on base **505** of container **500** (rather than on container wall **501**), container **500** and cap **503** are similar in many other respects to the previously described containers and caps. Features of container **500** and cap **503** that are similar to features of container **100** and cap **103** are provided with similar reference numerals preceded by the digit "5" rather than "1".

[0052] Container **500** differs from the embodiment previously described in that cap retainer **510** comprises a generally circularly symmetric depressed region **510A** (rather than an elongated slot), which is located in base **505** of container **500** (rather than in container wall **501**). Depressed region **510A** may be formed between a plurality of lobes **531**, which extend inwardly from a perimeter of base **505**. In the illustrated embodiment, lobes **531** comprise bottom surfaces which, together with perimeter region **507** of base **505**, allow container **510** to stand upright on a flat surface. In the illustrated embodiment, container **500** comprises three lobes **531** evenly spaced apart around the circularly symmetric shape of depressed region **510A**. In general, the number of lobes **531** may vary, provided that there are one or

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more lobes 531. In addition, although lobes 531 are preferably evenly spaced about depressed region 510A, this is not a requirement.

- 5 [0053] Cap 503 is inserted directly inwardly into depressed region 510A. A person simply pushes cap 503 into depressed region 510A between lobes 531. Alternatively, if cap 503 is located on a surface, a person may place container 500 over cap 503, such that cap 503 is aligned with depressed region 510A and the surface pushes cap 503 into depressed region 510A.
- 10 [0054] When cap 503 is located in depressed region 510A, cap 503 is in its storage configuration. The innermost surfaces 531A of lobes 531 define the circularly symmetric shape of depressed region 510A, which may correspond to the shape of cap 503. The innermost surfaces 531A of lobes 531 form contact surfaces, which engage outer surface 546 of side portion 546A of cap 503 to retain
- 15 cap 503 in its storage configuration. Cap 503 is retained in its storage configuration by frictional forces existing between contact surfaces 531A and outer surface 546 of side portion 546A of cap 503. In addition, cap 503 may be maintained by the pressure associated with the elastic deformation of cap 503 and/or lobes 531. In such embodiments, the contact surfaces 531A of cap retainer 510 may exert pressure
- 20 on cap 503, such that side portion 546A of cap 503 is deformed as shown in Figure 6B. As shown in Figure 6B, the radius of side portion 546A of cap 503 may contract in the region of contact surfaces 531A and may expand in the regions of gaps 533.
- 25 [0055] Preferably, as shown in Figures 6A-6B, cap 503 is inserted into cap retainer 510 with its cap rim 518 facing into depressed region 510A and the exterior surface 545 of its top portion 545A facing downwardly. This orientation of cap 503 in cap retainer 510 promotes hygiene by minimizing the exposure of the cap opening and the interior surfaces of cap 503 to contamination. In addition, a person may
- 30 insert and remove cap 503 from cap retainer 510 without handling the interior surfaces of cap 503. Another benefit with this orientation is that less force is required to deform cap 503 when inserting it into cap retainer 510, as only the side portion 546A of cap 503 needs to be deformed and the top portion 545A of cap 503 need not be deformed. In some embodiments, only the region of side portion
- 35 546A closest to cap rim 518 need be deformed to insert cap 503 into cap retainer 510. Those skilled in the art will appreciate that the region of side portion 546A

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closest to cap rim 518 is more easily deformable than the region of side portion closest to top portion 545A. This orientation of cap 503 in cap retainer 510 also helps to prevent cap 503 from being permanently warped or broken because of excessive deformation.

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[0056] Cap retainer 510 also comprises a number of channels 533 located between lobes 531. Channels 533 are preferably large enough such that a person may fit one or more fingers in channels 533. Channels 533 permit a person to use their fingers to access cap 503 when it is stored in cap retainer 510 to facilitate removal of cap 503 therefrom. The person simply grasps side portion 546A of cap 503 and pulls it directly outwardly from depressed region 510A.

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[0057] In the illustrated embodiment, lobes 531 each have a rounded surface 534 at the entrance to depressed region 510A (see Figure 6A). Surface 534 helps to facilitate easy insertion of cap 503 into cap retainer 510. In addition, the contact surfaces 531A of lobes 531 are preferably provided with a tapering angle α (see Figure 6A), such that the dimension between contact surfaces 531A narrows as contact surfaces 531A extend deeper into recessed region 510A. Tapering angle α is measured from a longitudinal axis of container 500. When cap 503 is inserted into depressed region 510A in the orientation discussed above, tapering angle α causes the most deformation to occur in the region of side portion 546A closest to cap rim 518. As discussed above, it is easier to deform the region of side portion 546A closest to cap rim 518 than the region of side portion 546A closest to top portion 545A. Deforming this portion of cap 503 also helps to prevent cap 503 from being permanently warped or broken because of excessive deformation. Tapering angle α_1 may be selected on the basis of the elastic deformation properties and friction properties of the materials used for cap 503 and cap retainer 510, such that cap 503 is adequately secured in cap retainer 510 without permanently warping or breaking cap 503. In some embodiments, tapering angle α is in the range of 0-5°.

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[0058] Figures 7A-7B depict a container 600 and its cap 603 according to yet another embodiment of the invention.. Container 600 and cap 603 are similar in many respects to container 500 and cap 503 described above. Features of container 600 and cap 603 that are similar to features of container 500 and cap 503 are provided with similar reference numerals preceded by the digit "6" rather than "5".

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[0059] One difference between container 600 and container 500 is that base 605 of container 600 does not have a perimeter region 507 and that lobes 631 comprise flat bottom surfaces 609 for supporting container 600 in an upright position when it is resting on a surface. In addition, in the illustrated embodiment of Figures 7A-7B, cap retainer 610 comprises five lobes 631 instead of the three lobes 531 of container 500 of Figures 6A-6B. Those skilled in the art will appreciate, however, that cap retainers 510, 610 may generally comprise different numbers of lobes 531, 631. Although lobes 631 are preferably evenly spaced about depressed region 610A, this is not a requirement. Cap 603 is inserted and removed from cap retainer 610 in a manner similar to insertion and removal of cap 503 from cap retainer 510. Cap 603 is retained in cap retainer 610 by frictional forces between contact surfaces 631A of lobes 631 and outer surface 646 of side portion 646A of cap 603 and/or by pressure associated with the deformation of cap 603 and/or lobes 631. In such embodiments, the contact surfaces 631A of cap retainer 610 may exert pressure on cap 603, such that side portion 646A of cap 503 is deformed as shown in Figure 7B. As shown in Figure 7B, the radius of side portion 646A of cap 603 may contract in the region of contact surfaces 631A and may expand in the regions of gaps 633.

[0060] Figures 8A-8B depict a container 700 and its cap 703 according to yet another embodiment of the invention. Container 700 and cap 703 are similar in many respects to container 600 and cap 603 described above. Features of container 700 and cap 703 that are similar to features of container 600 and cap 603 are provided with similar reference numerals preceded by the digit "7" rather than "6".

[0061] One difference between container 700 of Figures 8A-8B and container 600 of Figures 7A-7B is that contact surfaces 731A of lobes 731 of cap retainer 710 and/or outer surface 746 of side portion 746A of cap 703 are coated with a layer 711 of elastomeric material. Layer 711 of elastomeric material may increase the friction between contact surfaces 731A and outer surface 746 of side portion 746A of cap 703. In addition, layer 711 of elastomeric material may itself deform when cap 703 is inserted between lobes 731, such that the pressure created by the deformation of layer 711 may tend to secure cap 703 in cap retainer 710. For this reason, container 700 is particularly well suited for caps and/or containers fabricated from substantially non-deformable materials. Those skilled in the art will

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appreciate that any of the embodiments described herein may make use of caps and/or container contact surfaces which have been coated with elastomeric material.

[0062] Containers according to any of the above described embodiments of the invention may be designed to hold pressurized or non-pressurized contents.

Containers according to the various embodiments of the invention, may be made of relatively rigid material(s) such as hard plastic, glass or metal, or semi-rigid, elastically deformable materials, such as elastically deformable plastic. Suitable elastically deformable plastics include polyethylene terephthalate (PET) and high-density polyethylene (HDPE) for example. Different parts of the containers may comprise different materials. For example, any of the containers in accordance with the invention may comprise container walls made of a rigid metal, while the cap retainer may be made of a different rigid or semi-rigid material or may be coated with a layer of elastomeric material.

[0063] As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or scope thereof. For example:

- Figures 9A-9D show a container 800 and a cap 803 according to an alternative embodiment of the invention. Side portion 805 of cap 803 comprises one or more radially extending projections 807, each of which spans an arcuate segment of the circumference of side portion 805. In the illustrated embodiment, as shown best in Figure 9D, cap 803 comprises three circumferentially spaced apart, radially extending projections 807. Projections 807 may be integrally formed with cap 803 or may be subsequently fused or otherwise added to cap 803. In some embodiments, projections 807 comprise elastomeric material. Container 800 comprises a cap retainer 810 which completely encircles cap 803 when cap 803 is retained therein. That is, cap retainer 810 comprises a depressed region 812 but does not have spaced apart lobes. However, container 800 does comprise a single annular rim 809 upon which container 800 stands when it is in an upright orientation. Container 800 also comprises a curved surface 811 between rim 809 and depressed region 812. When cap 803 is inserted into cap retainer 810, projections 807 contact side surface 815 of depressed region 812 at spaced apart locations 813. Cap 803 may deform as shown in Figure 9B. More particularly, side portion 805 of cap 803 may contract radially in the regions of projections 807 and may expand radially in the

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regions between projections 807. As shown best in Figure 9A, side portion of cap 803 may be deformed by an angle δ in the region of projection 807. Deformation angle δ depends on a number of factors, including the material used to form cap 803 and projections 807 and the dimension of cap 803 and projections 807. Deformation angle δ may be in the range of 0-10°. In some embodiments, for example where elastomeric material is employed, deformation angle δ may be significantly higher. In other respects, container 800 and cap 803 may be similar to the other embodiments described herein.

- 10 • Figures 10A-10B show a container 850 and a cap 853 according to another alternative embodiment of the invention. Container 850 comprises a cap retainer 860 that is substantially similar to cap retainer 110 of Figures 2A-2D, except that cap retainer 860 is located in the base 855 of container 860 and that base 856 of cap retainer 860 comprises a curved portion 856A near its open end 858. In other respects, container 850 and cap 853 may be similar to the other embodiments described herein.
- 15 • Figures 11A and 11B show a container 900 and a cap 903 according to another alternative embodiment of the invention. Container 900 comprises a cap retainer 910 that is substantially similar to cap retainer 210 of Figures 3A-3D, except that cap retainer 910 is located in the base 905 of container 900 and that base 916 of cap retainer 910 is flat at both of its ends, rather than having curved portion 219 near one of its open ends. In other respects, container 900 and cap 903 may be similar to the other embodiments described herein.
- 20 • The illustrated embodiments depicted above show screw on caps. In alternative embodiments of the invention, caps may comprise any type of lid, stopper, cork, seal or the like which seals a container opening. Such caps may comprise screws for engaging the rim of a container or may comprise other means for engaging the container so as to seal the container opening.
- 25 • For example, such caps may be "snap-on" caps which snap onto the rim of the container opening, deformable caps which fit into an interior of the rim of the container opening or may be otherwise coupleable to the container to seal the container opening.
- 30 • Container 100 shown in Figures 2A-2D and container 200 shown in Figures 3A-3D are shown as having optional additional cap retainers 106, 206 located in a side of container walls 101, 201 opposite that of cap retainers 110, 210. Those skilled in the art will appreciate that other embodiments of
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the invention described herein may also be provided with optional additional cap retainers.

- Cap 303 shown in Figures 4A-4C and cap 403 shown in Figures 5A-5C comprise radially outwardly extending lips 320, 420 and the sidewalls 314, 315, 414, 415 of the slots of containers 300, 400 comprise corresponding grooves for receiving lips 320, 420. Those skilled in the art will appreciate that other embodiments of the invention described herein may also be provided with caps having radially outwardly extending lips and cap retainers having contact surfaces with corresponding grooves for receiving such lips. In alternative embodiments, lips 320, 420 need not extend around the circumference of their respective caps 303, 403 and may comprise one or more radial projections that span an arcuate segment of the circumference of their respective caps 303, 403. In alternative embodiments, the contact surfaces of cap retainers may be provided with projecting lips and caps may be provided with corresponding grooves.
- Container 700 and/or cap 703 of Figures 8A-8B described above comprise a layer 711 of elastomeric material which is coated onto contact surfaces 731A of its cap retainer 710 and/or to exterior surface 746 of the side portion 746A of cap 703. Those skilled in the art will appreciate that the retaining capability of the cap retainers of any of the above described embodiments may be increased by coating the contact surfaces of the cap retainer and/or the corresponding surfaces of the cap with a layer of elastomeric material. The increase in retaining capability may be due to increases in friction caused by the elastomeric coating and/or increased pressure associated with deformation of the elastomeric coating. With elastomeric coatings, the tapering angles α , β of the above described embodiments may be substantially greater because the elastomeric coatings tend increase the friction between the cap and the contact surfaces. In some embodiments, the tapering angles α , β may be as high as 20°.
- The contact surfaces of any of the cap retainers described above and/or the corresponding surfaces of the caps may be provided with friction enhancing features, such as ridges, bumps or grooves which enhance the frictional forces therebetween. Such friction enhancing features may be integrally formed with the contact surfaces of the cap retainers and/or the corresponding surfaces of the caps or may be subsequently added to the contact surfaces of the cap retainers and/or the corresponding surfaces of the

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caps. The friction enhancing features may be formed from an elastomeric material.

- The embodiments described above depict beverage containers typically referred to as "bottles". The invention is particularly well suited for beverage containers, because the cap may be hygienically stored and reused to seal the container and because storage of the cap allows the user to drink from the beverage container while performing other tasks with at least one of their hands. In addition, the provision of tapering angles α , β in the embodiments described above, allows caps to be deformed most significantly in the regions of the side portions closest to their cap rims. This makes it easier to deform the caps and prevents permanent warpage and breakage of the caps. This feature is particularly useful for beverage containers which may leak if their caps are permanently warped or broken. Despite these advantages which are directly applicable to beverage containers, the invention described herein is not limited to beverage containers. Alternative embodiments of the invention provide containers for holding other fluids, semi-fluids and/or solid contents.
- Some of the above described embodiments have slot shape cap retainers having sidewalls with sidewall points and curved contact surfaces. In some embodiments, one or both of the sidewalls of slot shaped cap retainers are straight (i.e. are not provided with sidewall points or curved portions). In such embodiments, cap may be held in part by the pressure associated with deformation of the cap against a straight contact surface of the straight sidewall.
- Container 400 of Figures 5A-5C comprise a cap retainer 410 having gaps 426, 427 between its sidewall portions 414A, 414B, 415A, 415B. The size of these gaps may be increased, such that only the corners of sidewall portions 414A, 414B, 415A, 415B form contact surfaces which engage the cap 403.
- In the above described embodiment, the slot-shaped cap retainers are located on the sides or on the bases of their corresponding containers. In the above-described embodiments, the slot-shaped cap retainers located on the sides of their corresponding containers are oriented such that the longitudinal axis of the slot corresponds to the longitudinal (vertical) axis of the container. This is not necessary. In general, the longitudinal axis of the slot may have any orientation with respect to the longitudinal (vertical) axis of the container.

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- Cap retainers similar to cap retainers **510, 610, 710** may be located on the side portions of their corresponding containers.

Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.